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(54) **Process for manufacturing motor car steering wheels with an external shell made of composite materials**

Herstellungsverfahren für ein Kraftfahrzeuglenkrad mit einer äusseren Hülle aus Verbundmaterial

Procédé de fabrication d'un volant de direction pour véhicules automobiles avec une enveloppe extérieure en matériaux composites

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Description

[0001] The present invention relates to a process for manufacturing motor car steering wheels with an external shell made of composite materials and the steering wheel thus obtained.

[0002] The steering wheels for motor cars are presently made of an internal metallic core covered by resin and of an external coating and finishing shell, made of various materials, which represents the appearing part of the steering wheel.

[0003] Among the several known processes for manufacturing motor car steering wheels it is to be noticed the process providing for formation of two half-shells by hot pressing of one or more material sheet inside moulds of suitable shape, subsequent mechanical flattening working of the junction line of the two half-shells, application of the half-shells on a steering wheel body formed by a metallic core covered by resin and mutual fixing of the two half-shells along said junction line.

[0004] Object of the present invention is to improve this known process to make it particularly suitable for providing a steering wheel with half-shells of composite materials solidly joined together.

[0005] According to the invention this object is obtained by a process comprising preparation of piles of sheets of composite materials, hot moulding thereof for obtaining respective half-shells with a shape corresponding to that of respective halves of the steering wheel being manufactured, mechanical flattening of the front surfaces of the two half-shells, application of the two half-shells to opposite parts of a steering wheel body formed by a metallic core covered by resin and mutual fixing of the two half-shells along said front surfaces, characterized in that after flattening said font surfaces of the two half-shells are mechanically worked to form respective complementary teeth which can be male-female coupled when the two half-shells are applied around said steering wheel body.

[0006] It has been possible to verify that the presence of complementary teeth at the junction lines of the two half-shells allows to provide a very strong connection between the half-shells which is able to resist all the ageing and safety test required by the automobile manufacturers.

[0007] The features of the present invention will be made more evident by the following detailed description of an embodiment thereof which is illustrated by non-limiting way in the accompanying drawings, in which:

Figure 1 shows, partly in view and partly in section, a typical steering wheel for motor car;
Figure 2 schematically shows several steps of the manufacturing process according to the present invention;
Figure 3 shows a partial perspective representation of a half-shell after the hot moulding step and the subsequent flattening step and before the provision of the coupling teeth;
Figure 4 shows in perspective view, just before the final assembling of the two half-shells, a portion of a steering wheel manufactured by the process according to the invention;
Figure 5 shows the same steering wheel in cross-section, in assembled condition;
Figure 6 shows a variant of the steering wheel of Figure 5, further in cross-section, in assembled condition.

[0008] As shown in Figure 1, a typical steering wheel for motor car is composed by a central part or hub part 1, a plurality of radial spokes 2 and an external rim 3.

[0009] According to the present technology the external rim 3 and the spokes 2 consist of an internal metallic core 4 covered by resin 5 and an external coating and finishing shell, in its turn formed by two half-shells 5 superimposed to each other and joined together.

[0010] The two half-shells 6 are manufactured by using the technology schematically illustrated in Figure 2, steps a)-d).

[0011] More precisely, the forming step provides for hot moulding of a pile of sheets of composite materials, globally designated with 7 in Figure 2, step a), inside a metal mould 8 with a cavity 9 of suitable shape, on which a cover 10 with a protrusion 10 of complementary shape with respect to the cavity 9 is superimposed.

[0012] The pile 7 may be composed by sheets of various thickness, for example from 0.1 to 0.6 mm that destined for contacting the resin, from 0.8 to 1.1 mm the intermediate one, from 0.1 to 0.8 mm that destined for constituting the external surface of the half-shell, so as to produce a total thickness of the half-shell which is comprised between 1.0 and 2.5 mm.

[0013] The single sheets may be of various materials, for example all composite fibres (glass fibres, carbon fibres, aluminium fibres, aramidic fibres, etc.), composite fibres and natural and/or synthetic materials (wood, brier-root, fabric, etc.), composite fibres and metal sheets (aluminium, etc.).

[0014] The above mentioned fibres may be impregnated with specific resins which at the end of the cycle are able to grant structural rigidity to the half-shell assembly. The resins used for impregnating the fibres can be of various nature, for example epoxy, polyester, polyurethane. The impregnation of the fibres may be carried out both before the use, by means of specific machines which dip the fabric into the resin according a specific process, and during the half-shell moulding step, by smearing, injection or other dispensing systems which allow impregnation of the fibres inside the mould.

[0015] The moulding time depends on the temperature being used and is comprised between 1 and 3.5 minutes. The mould temperature, for an optimal process, is comprised between 120 °C and 180 °C. The moulding pressure is determined by the amount of air which is left between the upper and lower half-shells.

[0016] The half-shell obtained at the end of the moulding operation is illustrated in Figure 2, step b), and comprises a curved central part 12 and two lateral fins 13. The latter are then removed by mechanical flattening working, step c) of Figure 2. The half-shell is then as shown in Figure 3.

[0017] Two so obtained half-shells are then subjected to a further mechanical working, step d) of Figure 2, which allows to obtain complementary coupling teeth 14 and 15 on the surfaces 16 of the same half-shells which are destined for resting and joining each other when the two half-shells go to form the final shell of the steering wheel. The shape and the location of the coupling teeth, shown herein by way of example, can vary according to the assembling necessities.

[0018] The final steps of the steering wheel manufacturing process, steps e) and f) of Figure 2, provide for application of a specific structural glue 17 at the coupling teeth 14 and 15 of two half-shells (and possibly on the steering wheel body 18), application of the two half-shells, step e), on opposite parts of a previously prepared steering wheel body (formed by the metallic core 4 and the resin covering 5 as previously said with reference to Figure 1), joining the two half-shells by male-female coupling of the teeth 14 and 15 and gluing of the same by the glue 17 to form one shell around the steering wheel body 18, and finally removal of the glue excess and painting of the completed steering wheel, step f).

[0019] It is to be noted that the steering wheel body 18 is preferably provided with two diametrically opposite grooves 19 which serve for compensating the thermal expansions of the resin 5.

[0020] The assembly of the two half-shells 6 and the steering wheel body 18 is shown in perspective view, just before the final assembling, in Figure 4.

[0021] The same assembly is shown in cross-section, with assembling being ended, in Figure 5.

[0022] A steering wheel with differently located coupling teeth 14 and 15 is in turn shown, still in cross-section and with the assembling being ended, in Figure 6.

Claims

1. Process for manufacturing motor car steering wheels with an external shell made of composite materials, comprising preparation of piles (7) of sheets of composite materials, hot moulding thereof for obtaining respective half-shells (6) with a shape corresponding to that of respective halves of the steering wheel being manufactured, mechanical flattening of the front surfaces (16) of the two half-shells, application of the two half-shells to opposite parts of a steering wheel body (18) formed by a metallic core (4) covered by resin (5) and mutual fixing of the two half-shells (6) along said front surfaces (16), characterized in that after flattening, said front surfaces (16) of the two half-shells (6) are mechanically worked to form respective complementary teeth (14, 15) which can be male-female coupled when the two half-shells (6) are applied around said steering wheel body (18).

2. Process according to claim 1, characterized in that the mutual fixing of the two half-shells (6) is obtained by application of glue.

3. Process according to claim 1, characterized in that said composite materials consist of composite fibres.

4. Process according to claim 1, characterized in that said composite materials consist of composite fibres and natural materials.

5. Process according to claim 1, characterized in that said composite materials consist of composite fibres and synthetic materials.

6. Process according to claim 1, characterized in that said composite materials consist of composite fibres and metal sheets.

7. Process according to any claim 3, 4, 5 or 6, characterized in that said composite fibres are impregnated by resin.

8. Process according to claim 1, characterized in that said hot moulding is carried out at a temperature comprised between 120 °C and 180 °C.

9. Process according to claim 1, characterized in that said hot moulding is carried out for a time comprised between 1 and 3.5 minutes.

Patentansprüche

1. Verfahren zur Herstellung von Kraftfahrzeuglenkrädern mit einer äußeren Hülle aus Verbundmaterial, das die folgenden Schritte aufweist: Herstellen von Stapeln (7) aus Verbundmaterialfolien; Heißformen dieser, um entsprechende Halbhüllen (6) mit einer Form zu erhalten, die der der entsprechenden Hälften des herzustellenden Lenkrades entspricht; mechanisches Abflachen der vorderen Flächen (16) der zwei Halbhüllen; Aufbringen der zwei Halbhüllen auf gegenüberliegende Teile eines Lenkradkörpers (18), der aus einem Metallkern (4) gebildet wird, der mit Harz (5) überzogen ist; und gegenseitiges Befestigen der zwei Halbhüllen (6) längs der vorderen Flächen (16); **gekennzeichnet dadurch, daß** nach dem Abflachen die vorderen Flächen (16) der zwei Halbhüllen (6) mechanisch bearbeitet werden, um entsprechende komplementäre Zähne (14,

15) zu bilden, die außen-innen gekoppelt werden können, wenn die zwei Halbhüllen (6) um den Lenkradkörper (18) herum aufgebracht werden.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß das gegenseitige Befestigen der zwei Halbhüllen (6) durch Aufbringen von Leim erhalten wird.

3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß die Verbundmaterialien aus Verbundfasern bestehen.

4. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß die Verbundmaterialien aus Verbundfasern und natürlichen Materialien bestehen.

5. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß die Verbundmaterialien aus Verbundfasern und synthetischen Materialien bestehen.

6. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß die Verbundmaterialien aus Verbundfasern und Metallfolien bestehen.

7. Verfahren nach jedem Anspruch 3, 4, 5 oder 6, **dadurch gekennzeichnet**, daß die Verbundfasern mit Harz imprägniert werden.

8. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß das Heißformen bei einer Temperatur zwischen 120 °C und 180 °C durchgeführt wird.

9. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß das Heißformen über eine Zeit zwischen 1 und 3,5 Minuten durchgeführt wird.

Revendications

1. Procédé de fabrication de volants de direction pour véhicules automobiles comportant une enveloppe externe composée de matériaux composites, comprenant les étapes de préparation de piles (7) de feuilles de matériaux composites, de moulage à chaud de celles-ci pour produire des demi-enveloppes respectives (6) ayant une forme correspondant aux moitiés respectives du volant de direction en cours de fabrication, d'aplatissement mécanique des surfaces avant (19) des deux demi-enveloppes, d'application des deux demi-enveloppes (6) sur les parties opposées d'un corps du volant de direction (18) comprenant un noyau métallique (4) recouvert par de la résine (5), et de fixation mutuelle des deux demi-enveloppes (6) le long desdites surfaces avant (16) **caractérisé en ce qu'après l'étape** d'aplatissement, lesdites surfaces avant (16) des deux demi-enveloppes (6) sont soumises à un traitement mécanique pour former des dents complémentaires respectives (14, 15) se prêtant à un accouplement mâle-femelle lors de l'application des deux demi-enveloppes (6) autour dudit corps du volant de direction (18).

2. Procédé selon la revendication 1, **caractérisé en ce que** la fixation mutuelle des deux demi-enveloppes (6) est réalisée par application de colle.

3. Procédé selon la revendication 1, **caractérisé en ce que** lesdits matériaux composites sont constitués par des fibres composites.

4. Procédé selon la revendication 1, **caractérisé en ce que** lesdits matériaux composites sont constitués par des fibres composites et des matériaux naturels.

5. Procédé selon la revendication 1, **caractérisé en ce que** lesdits matériaux composites sont constitués par des fibres composites et des matériaux synthétiques.

6. Procédé selon la revendication 1, **caractérisé en ce que** lesdits matériaux composites sont constitués par des fibres composites et des tôles.

7. Procédé selon l'une quelconque des revendications 3, 4, 5 ou 6, **caractérisé en ce que** lesdites fibres composites sont imprégnées de résine.

8. Procédé la revendication 1, **caractérisé en ce que** ledit moulage à chaud est réalisé à une température comprise entre 120°C et 180°C.

9. Procédé selon la revendication 1, **caractérisé en ce que** ledit moulage à chaud est réalisé pendant une durée comprise entre 1 et 3,5 minutes.

Fig.1

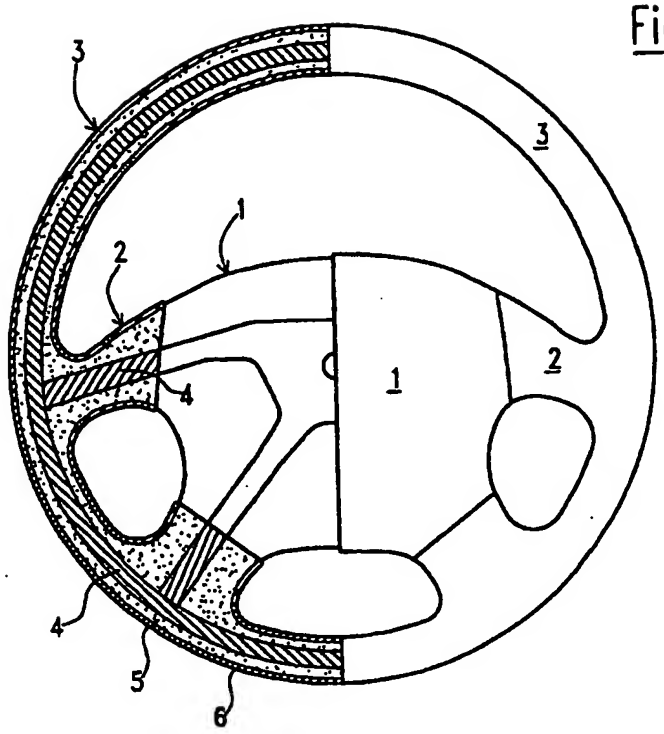
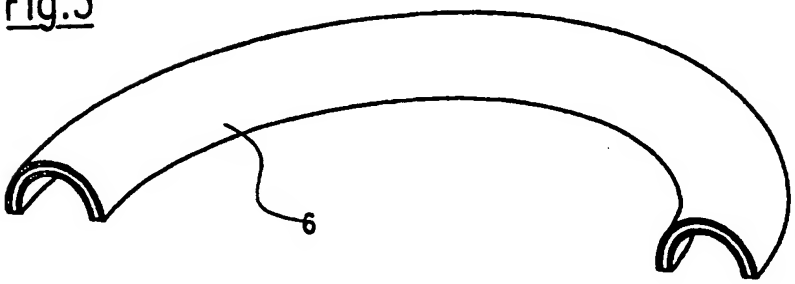


Fig.3



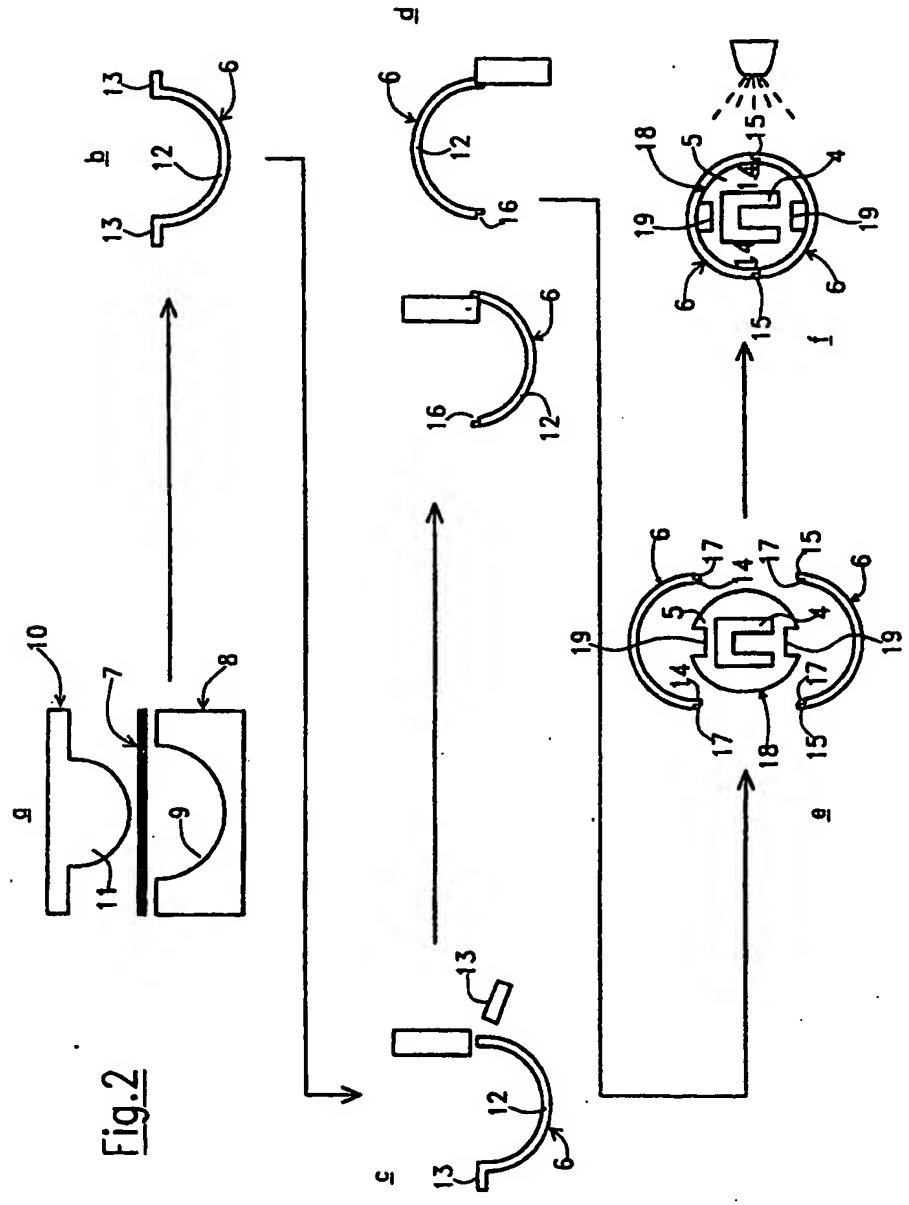


Fig.2

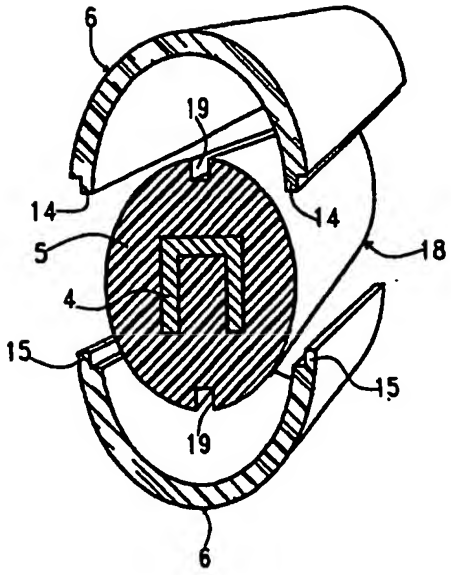


Fig.4

Fig.5

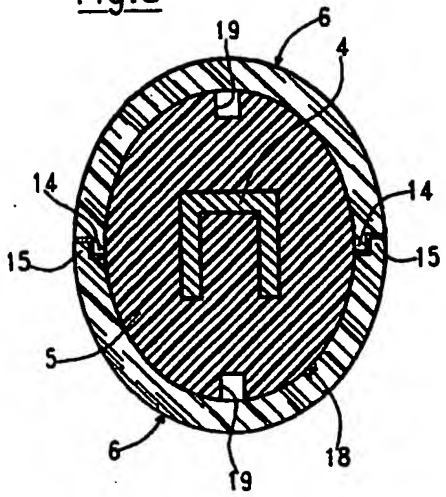


Fig.6